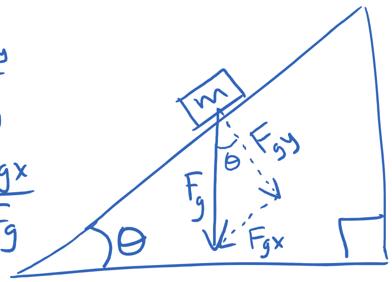
Dynamics Summary

October 13, 2017 10:28 AM

Inclined Planes

$\cos\theta = \frac{F_{gy}}{F_g}$

$\sin\theta = \frac{F_{gx}}{F_g}$



if there is friction

$F_{gy} = F_N = F_g \cos\theta$ ← useful for friction $F_f = \mu F_N$

$= mg\cos\theta$

F_{gx} = gravity acting downslope (opposite to friction)

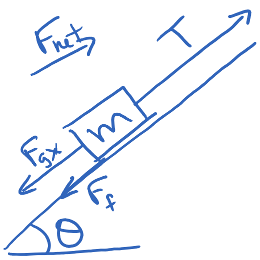
$= F_g \sin\theta$

$= mg\sin\theta$

Situation 1

pulled up incline (accelerating)

F.B.D.



applied force

$F_{net} = T - F_{gx} - F_f$

$ma = T - mg\sin\theta - \mu mg\cos\theta$

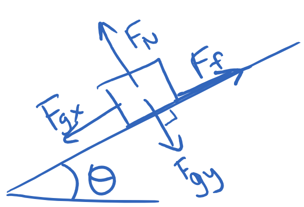
if not accelerating then $F_{net} = 0$

↖ $v = 0$ or v = constant $\quad 0 = T - F_{gx} - F_f$

Situation 2

sitting still $F_{net} = 0$ (not being pulled)

FBD



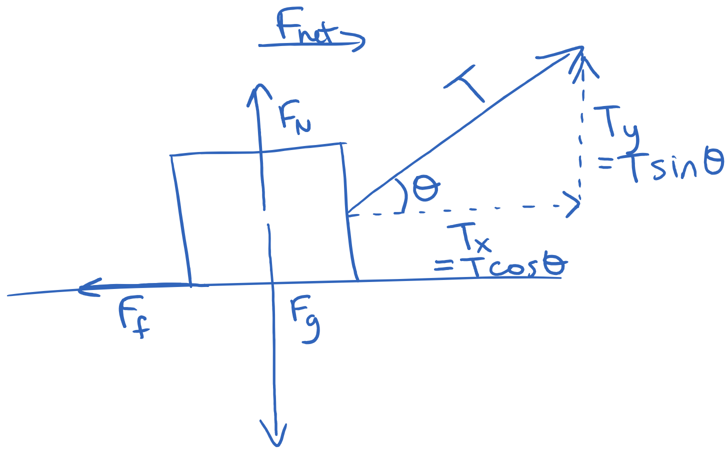
$F_{net} = 0 = F_{gx} - F_f$

$0 = \cancel{mg}\sin\theta - \mu \underbrace{\cancel{mg}\cos\theta}_{F_N}$

$\mu = \frac{\sin\theta}{\cos\theta} = \tan\theta$

μ $T\cos\theta$

Situation 3: Pulling at an angle



vertically

$F_g = F_N + T_y$

or $F_N = F_g - T_y$

horizontally

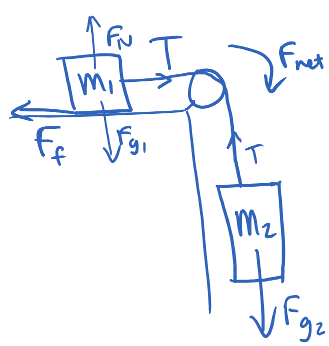
$F_{net} = T_x - F_f$

$= T\cos\theta - \mu F_N$

$= T\cos\theta - \mu(F_g - T_y)$

$ma = T\cos\theta - \mu(mg - T\sin\theta)$

Situation 4



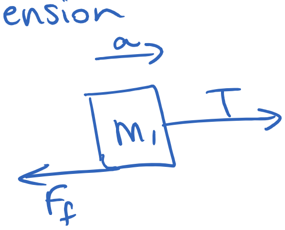
find acceleration

$F_{net} = F_{g2} - F_f$

$(m_1 + m_2)a = m_2 g - \mu m_1 g$

find Tension

FBD



$F_{net} = T - F_f$